Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 2001		**00-00-2001 to 00-00-2001**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Uncertainties And Interdisciplinary Transfers Through The End-To-End System (Unites): Capturing Uncertainty In The Common Tactical Environmental Picture	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **College of Oceanic and Atmospheric Sciences,,Ocean Admin. Bldg. 104,Oregon State University,,Corvallis,,OR, 97331**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

UNITES is a unique interdisciplinary team with expertise spanning the environment (physical oceanography and bottom geology), ocean acoustics (propagation, ambient noise, reverberation and signal processing), and tactical sonar systems. The overall goals of the research are to enhance the understanding of the uncertainty in the ocean environment (including the sea bottom), characterize its impact on sonar system performance, and provide the Navy with guidance for understanding sonar system performance in the littoral. Professor Miller will be involved in the explicit calculation of the transfer of uncertainty from the environment through the sonar system outputs.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**3**	

Uncertainties And Interdisciplinary Transfers Through The End-To-End System (Unites): Capturing Uncertainty In The Common Tactical Environmental Picture

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Award Number: N000140110821

LONG-TERM GOALS

UNITES is a unique interdisciplinary team with expertise spanning the environment (physical oceanography and bottom geology), ocean acoustics (propagation, ambient noise, reverberation and signal processing), and tactical sonar systems. The overall goals of the research are to enhance the understanding of the uncertainty in the ocean environment (including the sea bottom), characterize its impact on sonar system performance, and provide the Navy with guidance for understanding sonar system performance in the littoral. Professor Miller will be involved in the explicit calculation of the transfer of uncertainty from the environment through the sonar system outputs.

OBJECTIVES

Specific objectives of the team effort are to:

1) Develop generic methods for efficiently and simply characterizing, parameterizing, and prioritizing sonar system variabilities and uncertainties arising from regional scales and processes.
2) Construct, calibrate and evaluate uncertainty and variability models, for the sonar systems and its components, to address forward and backward transfer of uncertainties.
3) Transfer uncertainties from the acoustic environment to the sonar and its signal processing, in order to effectively characterize and understand sonar performance and predictions.

APPROACH

Our technical approach is based on utilizing environmental probability density functions (PDF) to provide a description of sonar performance. The PDFs will be determined for appropriate spatial and temporal scales as dictated by the systems under consideration. In particular, these PDFs will be determined for the following: meso- and sub-mesoscale fronts and eddies, tides, internal tides, waves and solitons, interference variability (ambient noise and reverberation) and spatially variable bottoms. Professor Miller will work with teammates on design, performance and evaluation of Monte-Carlo experiments which will be used to calculate explicit PDF's, and evaluation of the resulting PDF's themselves.

WORK COMPLETED

Professor Miller attended the ONR Kick-Off Meeting held at University of Washington, Applied Research Laboratory in June 27 and 28, 2001 and contributed to the presentation of an overview of the UNITES Team Approach. The presentation, entitled "Uncertainties and Interdisciplinary Transfers Through the End-to-End System (UNITES): The UNITES Team Approach" was presented by Allan Robinson (Harvard University) and Phil Abbot.

RESULTS

IMPACT/APPLICATIONS

The primary application is to assist the sonar "prediction community" by providing a probabilistic representation of sonar system performance. The present approach provides a systematic method to incorporate uncertainties due to the environment and to transfer the effects of these uncertainties, in the end-to-end problem through the sonar systems under consideration. The operator can thus use this information to operate the system more effectively and make more informed decisions on search, risk, expenditure of assets (weapons) and assumptions of covertness.

TRANSITIONS

RELATED PROJECTS

“Theory and Practice of Data Assimilation in Ocean Models” is an ongoing project sponsored by ONR with Professor Miller as PI. Recent work has emphasized calculation of PDF's of an increasingly complex sequence of strongly nonlinear models. Work was begun with highly schematic models. Succeeding models capture more and more properties of realistic ocean models.

REFERENCES

PUBLICATIONS